



Case Report

Fatal propeller injuries: Three autopsy case reports

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ABSTRACT

Most propeller injuries occur at water recreational facilities such as those with provision for water skiing, boat racing, skin and scuba diving. Propeller injuries resulting from nautical accidents can be fatal. The sharp blades of propellers rotating at high speeds cause multiple and serious injuries such as deep laceration, chop wounds, bone fractures and mutilation of extremities. We present the autopsy reports of three people who died after colliding with boat propellers.

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1. Introduction

Propeller injuries resulting from nautical accidents can be fatal. According to a previous report, the frequency of propeller accidents is greater than one in every 20 boating accidents, and the fatality rate in propeller accidents is 15–23%.^{1–3} The sharp blades of propellers rotating at high speeds cause multiple and serious injuries such as deep lacerations, chop wounds, bone fractures, and mutilation of extremities.⁴ We present the autopsy reports of three people who died after colliding with boat propellers.

2. Case reports

2.1. Case 1

A 60-year-old man who was fishing on his small boat (length, 7.75 m; weight, 640 kg; four-hp diesel engine) was thrown overboard when his boat collided with a large boat (length, 11.3 m weight, 4600 kg; 70-hp diesel engine). He was run over by the propeller of the large boat, which was 80 cm in diameter and had three blades. The length and width of each blade were 41 cm and 26 cm, respectively (Fig. 1a). One of the blades was slightly bent and had scratches. When the two boats collided, the large boat had a speed of approximately 10 knot/h (18.52 km/h).

The corpse showed multiple parallel lacerations on the right side, and the right leg was amputated at the middle of the thigh (Fig. 1b and c). The lacerations were evenly distributed on the right

side of the body and involved fractures of the ribs, scapula, right humerus, and femur. A mutilated part of the lower limb, the part below the ankle, was retrieved from the sea (Fig. 1d). However, the part of the limb from the knee to the ankle that was amputated around the knee and approximately 45 cm in length could not be found. Internal examination revealed crush injuries on the right lung and liver. The right side of the thoracic wall was damaged, exposing the right thoracic cavity. The weights of the two lungs were 550 g and 500 g, and the bronchi contained no foam or fluid. The heart contained little blood, and the main organs were exsanguinated. We concluded that the cause of death was massive hemorrhage due to propeller injuries.

2.2. Case 2

A 53-year-old diver who was afloat at sea and waiting for a pickup boat collided with a boat. The driver of the boat did not see him. The boat was 9.15 m in length, weighed 2000 kg, and had a 45-hp diesel engine. The speed of the boat at the time of the accident is not known. The propeller of the boat was 60 cm in diameter and had three blades. Each blade was 29 cm in length and 18 cm in width (Fig. 2a). Although the blades were not damaged, a piece of the victim's wet suit was found on the shaft of the propeller.

The corpse had multiple parallel chop wounds on the right side (Fig. 2b), which were evenly distributed and involved fractures of the ribs, pelvis, and right lower limb. The chop wounds exposed the abdominal and thoracic cavities. The weights of the two lungs were 210 g and 320 g, and a small amount of fluid without foam was found in the bronchi. His face showed a deep chop wound

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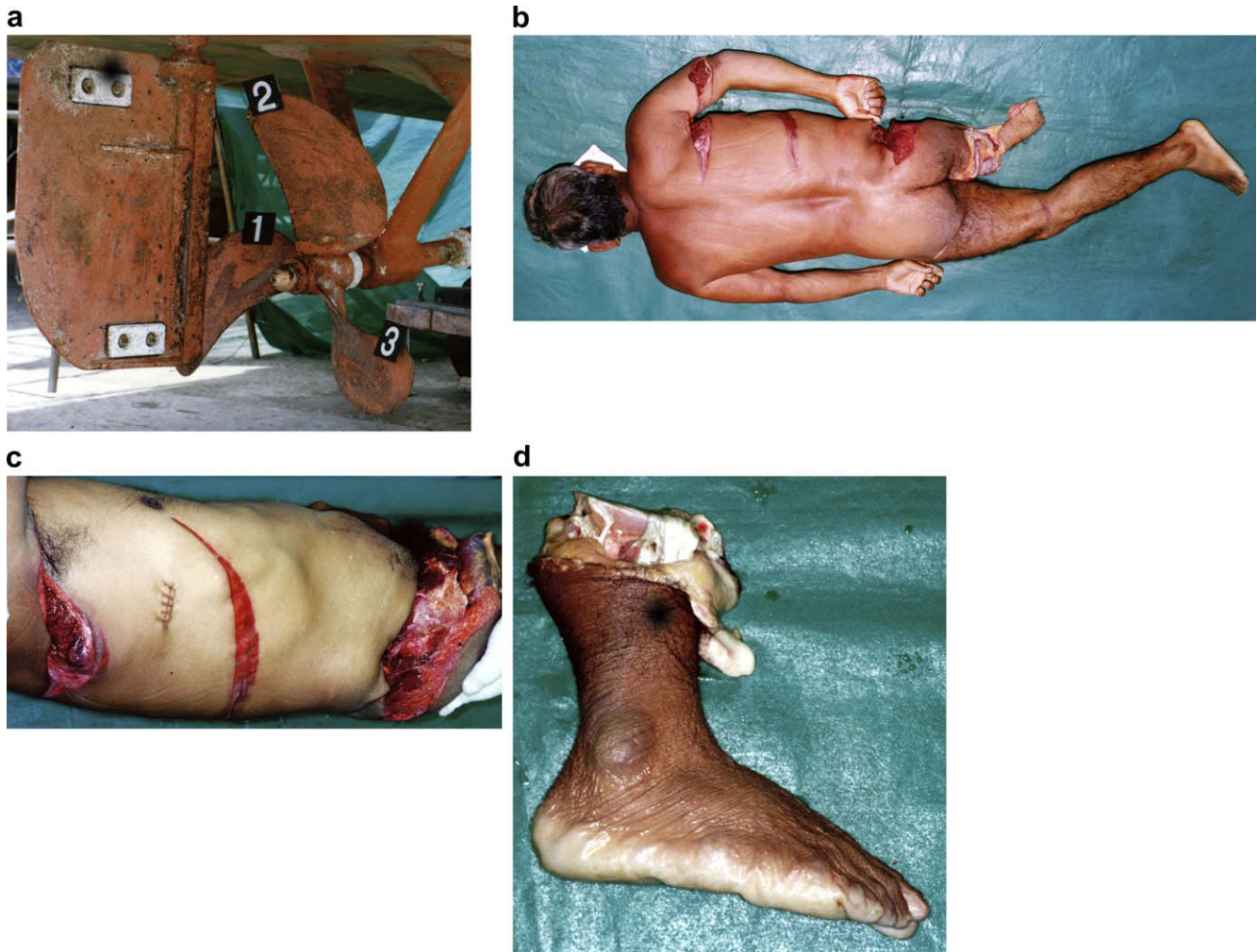


Fig. 1. Case 1: (a) Propeller of the boat involved. (b) Multiple parallel chop wounds observed on the corpse. (c) Chop wounds evenly distributed on the right side. (d) Mutilated lower limb.

from the forehead to mandible that was 30 cm in length. The chop wound exposed the cranial cavity, and the left hemisphere of the brain was missing (Fig. 2c). The weight of the brain remnants was 750 g.

The cause of death was brain damage due to the chop wound on the head inflicted by the propeller blades.

2.3. Case 3

A motorboat (length, 10.6 m; weight, 100 kg; 70-hp diesel engine) collided with a 22-year-old scuba-diving instructor who was floating on the surface of the sea. She and her companion were about to dive underwater when the accident occurred. The victim was not seen after the accident, and the marine police later recovered her corpse from the bottom of the sea. The propeller of the motorboat was 46 cm in diameter and had three blades. Each blade had a length of 24.5 cm and a width of 27 cm (Fig. 3a). The blades were bent and had scratches. The speed of the boat at the time of the accident is not known.

The corpse had a severe deep chop wound with a length of 24 cm on the forehead (Fig. 3b). The wound was associated with a skull fracture that had caused the cranial cavity to be exposed (Fig. 3c). The brain was severely damaged and weighed 1280 g, and the bilateral frontal lobe was missing. Slight subarachnoid hemorrhage and coagulated hematoma were observed in both

cerebral ventricles. The weights of the two lungs were 380 g and 480 g, and the bronchi contained no foam and a small amount of fluid. There were no injuries on the body, except on the head.

The cause of death was brain damage due to the chop wound on the head inflicted by the propeller blades.

3. Discussion

Most propeller injuries occur at water recreational facilities such as those with provision for water skiing, boat racing, and skin and scuba diving.² The increasing popularity of such facilities is expected to lead to an increase in the number of victims of propeller accidents. Although boating accidents are classified as transportation accidents, the severity of propeller injuries, which is comparable to battlefield injuries, far surpasses injuries seen in the case of accidents involving other motor vehicles.⁵ Most propeller injuries are severe wounds and typically involve multiple deep lacerations and chop wounds. The available literature reveals an overall fatality rate of 15–23%, and a similar rate of major amputations.⁵ Half of the deaths resulting from propeller injuries occur at the scene of the accident. People in water are always in danger of drowning. Therefore, injuries received in water can further increase the risk of death.



Fig. 2. Case 2: (a) Propeller of the boat. (b) Multiple parallel chop wounds observed on the corpse. (c) Chop wound on the head.

Propellers convert rotational motion into thrust required for the propulsion of a ship through water. A ship moves forward because of the backward displacement of water by the rotating blades of the propeller. According to Mendez-Fernandez,⁵ theoretically, a typical three-blade propeller rotating at 3200 rpm and with a blade length of 13 in. (33.2 cm) can cut an average person from the head to the toes in less than one tenth of a second. Contact between a rapidly rotating propeller and a human body results in multiple impacts of great force on the human body within a split second.

The corpses in cases 1 and 2 had propeller injuries throughout their body. We believe that the victim in case 1 was sucked into the propeller from his foot. He suffered at least two amputations on his lower limb—in the femoral and crural regions. If the femur was severed before the crural mutilation, the entire lower limb would have been unsteady without support. The complete mutilation of an unsteady limb appears unlikely. Therefore, we believe

that injuries were inflicted starting from the foot. Propellers of high-speed ships forcefully aspirate water in the forward direction, and floating objects are strongly drawn toward the propeller by a powerful force. Even if a victim attempts to swim away from the boat, the rapidly rotating propeller sucks him. It is possible that the victim in case 1 tried to escape the approaching boat.

In case 3, there was only a chop wound on the head of the victim and there were no multiple lacerations. This indicates that only her head was in the vicinity of the rotating propeller and the rest of the body was out of reach of the propeller. It cannot be determined whether she was on the surface of the water or underwater at the time of the accident. It is difficult to notice a human head on the surface of the water from a ship, especially in poor weather conditions.⁶ Head injury with brain damage is fatal and causes immediate death, and the victims in cases 2 and 3 did not show signs of drowning.

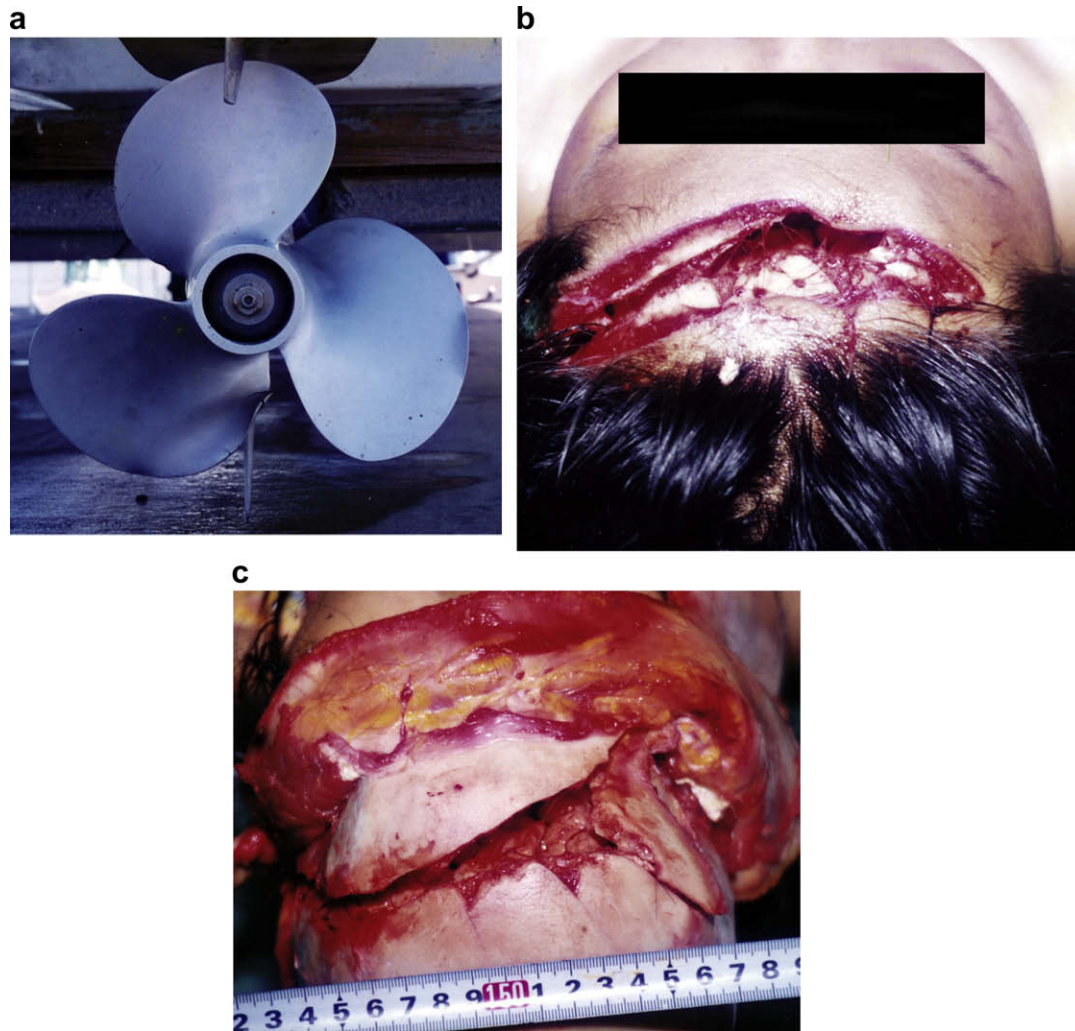


Fig. 3. Case 3: (a) Propeller of the boat involved. (b) Chop wound on the corpse. (c) Open fracture of the skullcap.

Propeller injuries are commonly caused by high-speed propellers of motorboats and water ski engines rather than those of large vessels.⁷ In the three accidents discussed by us, the boats involved were relatively small boats, approximately 10 m in length. One of the reasons for such boats causing propeller injuries is believed to be that they often run close to swimmers or divers. The victims may not see the boat until it is too late owing to the high speed of the boat. In the United States of America, with the development of water sports, different approaches have been adopted for reducing propeller-related accidents, such as the promotion of safety devices and educational programs.⁸ We believe that the knowledge obtained from past instances of propeller accidents can be useful in ensuring the safety of water recreational facilities.

Conflict of Interest

None declared.

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Ethical Approval

No ethical approval is needed as it is a short report.

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